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No. 6

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**RADIATION OF THE EAR.\*†**

H. B. PERLMAN, M.D., Chicago.

Clinical and experimental studies about the effect of radiation on the ear have produced conflicting results. While many animal experiments appear to have shown a destructive action of radiation on the various components of the peripheral auditory apparatus, there have been many clinical reports of actual improvement of function following radiation of the ear. A thorough review of the literature on the subject has been prepared by Des Jardins.<sup>1</sup>

These conflicting reports are due to the lack of carefully controlled experiments, *i.e.*, manner of application of the radiation dose, inaccurate measure of the radiation dose, inaccurate functional tests and questionable interpretation of histological changes. Similarly, conclusions from the clinical studies have usually been based on poorly selected cases and poorly defined functional tests. Careful functional tests were included in a recent study by Kasabach,<sup>2</sup> but exact description of the ear is lacking.

With the present wide interest in radiation of the ear, further observations in this field of otology therefore seem indicated. Observations were made on a group of carefully selected cases and on carefully controlled animal experiments,

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\*From the Division of Otolaryngology of the University of Chicago.

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including tests for auditory function.

The problems studied fall under three main headings:

- A. The effect of radiation on the normal ear.
- B. The effect of radiation on the pathological ear.
- C. The effect of radiation on the injured ear.

*A. The Effect of Radiation on the Normal Ear.*

*1. Clinical Observations:*

Patients with carcinoma of one side of the nasopharynx treated by measured amounts of Roentgen rays are suitable for study. Most of the radiation passes through the region of both the labyrinths. The amount of radiation each labyrinth received was calculated by the Roentgenologist. The maximum rate of delivery was 15 R per minute and 300 R per day. The ear on the side opposite the carcinoma is usually normal and can be studied for the effect of these large doses of Roentgen rays on structure and function.

*Case 1:* Mrs. M. F., age 22, with a carcinoma of the left vault had a normal right ear. In the course of her Roentgen ray therapy she received about 4,900 R units to the region of the right cochlea during a period of 73 days. At the end of this time her ear was still normal and the audiogram showed no functional impairment. Two months later the ear was still negative.

*Case 2:* Mr. H. B., age 18, with a carcinoma of the right vault had a negative left ear with a normal audiogram. In the course of his Roentgen ray therapy he received about 5,900 R units to the region of the left cochlea in 44 days. Nine and 16 months later, tests showed no pathology in this ear.

*Case 3:* Mr. E. R., age 13, with a carcinoma of the right vault had a normal left ear. In the course of his Roentgen ray treatment he received about 5,500 R units in 40 days through the region of the left cochlea. When last tested, four months after completing his course of treatment, the left ear was negative and the audiogram was normal.

*Case 4:* Mr. J. M., age 42, had a carcinoma of the left vault. His right ear was objectively normal and the functional tests showed only a high tone loss in the audiogram, maximum at 4,096. The patient gave a long history of exposure to great noise as a steel chipper and this high tone loss was attributed to acoustic trauma. It was not affected by radiation. He received about 3,300 R units of radiation in 40 days through this ear and when examined at the end of this period no objective or subjective change in the right ear was found.

*Case 5:* Mr. R. N., age 23, had a carcinoma in the right vault and a normal ear on the opposite side and a normal audiogram. His left ear was exposed to about 5,100 R in 39 days. Examination five months after radiation showed normal function of the left ear.

*Case 6:* Mr. J. H., age 48, with a carcinoma of the right vault has a normal ear on the opposite side and a normal audiogram except for about a 40 dc. drop at 4,096 and 8,192. This ear was exposed to about 5,550

units of X-ray and showed no change in appearance or function when examined a year later.

**Comments:** No detrimental effect on the structure or function of the peripheral auditory system was observed in these human ears exposed to very heavy tumor doses of Roentgen rays delivered at not over 15 R per minute and 300 R per day.

**Experimental Observations:** While many previous reports indicate a detrimental effect of radiation on the end-organs of the ear, Nager<sup>8</sup> saw no pathology in the end-organs near the site of fistulas exposed to radium.

**Experimental Procedure:** The ears of healthy young rabbits were exposed to measured amounts of Roentgen rays. Prior to this exposure both bullae were opened under sterile conditions. A perforating lesion was made in one cochlea. The opening in the other bulla was used to read the acoustic threshold of contraction of the tensor tympani muscle. This was a quantitative test of auditory function of the peripheral auditory apparatus. The method for testing auditory function in the experimental animal was previously described in detail.<sup>4</sup> This normal auditory threshold for tensor contraction was used as a base line and was compared with threshold tests made after exposing the ear to measured amounts of radiation. At various intervals following radiation, the animals' hearing was tested and the labyrinths removed for section. Animals were carried for two weeks to one year after exposure to Roentgen radiation. The rays were generated at between 180 and 200,000 volts and 20 to 30 milliamperes and delivered at about 7 to 10 R per minute from about 50 cm. distance through 1 mm. aluminum 0.5 mm. Cu filter. No detrimental effect on cochlear function as tested by the acoustic tensor tympani reflex was found. One month after exposure to 3,000 and 5,000 units, tests showed no depression of function, and one year after radiation with 1,500 units, no change in threshold could be detected. The microscopic sections of the labyrinths of these animals showed no pathology.

TABLE 1.

Showing Normal Auditory Function One Year After Radiation of the Cochlea with 1,500 Units Roentgen Rays. Acoustic Threshold of Tensor Contraction, as Read on D B Scale of 2A Audiometer.

	128	256	512	1,824	2,048	4,096	
5/6/40	65	70	75	67	50	50	Before radiation.
5/9/41	60	70	70	70	45	45	1 year after 1,500 U. Roentgen rays.

This corroborates the findings in the patients studied that exposure of the cochlea to large amounts of radiation produced no objective or subjective change in the peripheral auditory mechanism.

*B. Effect of Radiation on the Pathological Ear.*

Only one type of ear pathology was studied. This was the pathology associated with obstruction of the Eustachian tube due to carcinoma of the nasopharynx. The clinical and pathological picture of this obstructive process is uniform and clearly defined, both by objective examination and functional tests. Patients complain of deafness in the affected ear and all tests show this to be conduction in type. Direct examination of the ear always shows fluid behind the drum, dis-

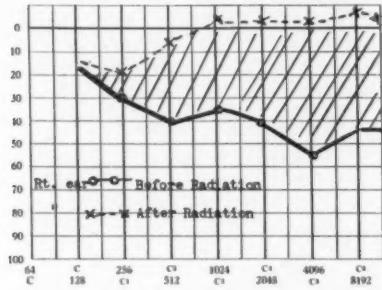


Chart 1. Mr. H. B.

persed in bubbles or lines, or complete filling of the middle ear, when one sees the characteristic yellowish drum with a chalky, thin line of the malleus. Indeed, the entire mastoid cell system may fill with fluid and produce clouding in the X-ray picture. Careful functional tests were made before radiation and at various intervals after the patient received adequate tumor dose of Roentgen rays at the rate described in Section A. Consistent maintained and spectacular reversal of the particular type of middle ear pathology was regularly seen as the result of the dissolution of the carcinoma and clearing of the vault. This was noted by auditory function tests, direct inspection of the ear, and sometimes by tubal function studies.

The following cases illustrate these findings:

*Case 1:* Mr. H. B., age 18, with carcinoma of the right vault complained of deafness in the right ear for eight months before the lesion was discovered. The right drum and the malleus handle had the typical appear-

ance of an exudative catarrh with fluid filling the entire middle ear. The Rinne test was negative and the Weber was referred to the affected ear. Following 5,900 units of radiation, the drum regained its normal appearance and the patient had a normal audiogram. At this time a 60 cycle sound introduced in the nose was transmitted through the tube at zero pressure on swallowing (see Chart 1).

**Case 2:** Mrs. R. C., age 25, had a large carcinoma largely filling the vault. Both ears were involved by tubal obstruction; the left more severely than the right. Four thousand one hundred fifty R of Roentgen

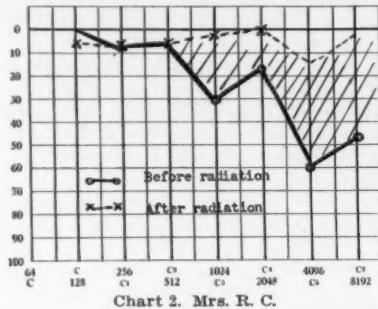


Chart 2. Mrs. R. C.

rays to the left ear in 55 days failed to open the left tube or change the findings of exudative catarrh. No appreciable improvement in function was noted in the audiogram. Original examination of the right drum showed evidence of fluid in the middle ear. The audiogram showed a high tone loss often seen in exudative catarrh and due to change of mass and damping of the conducting mechanism. Following 4,800 R units of Roentgen rays, the ear regained its normal appearance and the audiogram returned to normal (see Chart 2).

**Case 3:** Mrs. M. F., age 22, with a carcinoma of the left vault noted deafness for several months before a diagnosis was made. There was

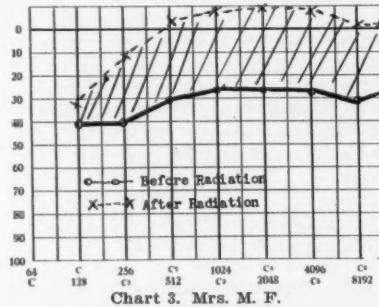


Chart 3. Mrs. M. F.

fluid behind the left drum, the left mastoid cells were clouded in the X-ray picture and the functional tests indicated a conduction deafness. After receiving 4,600 R in 73 days through this area, the ear regained its normal appearance and the audiogram returned to normal (see Chart 3).

**Case 4:** Mr. R. N. with a carcinoma of the right vault noted deafness, throbbing and tinnitus in the right ear for three months before a diagnosis was made. The drum was dull and the region of the malleus red,

with suggestion of fluid filling the middle ear. The functional tests were typical of conduction deafness. After receiving 5,100 R to this area in 39 days, the ear regained its normal appearance, and functional tests one month and five months later showed normal function except for a 4,096 dip in the audiogram. The reason for this continued dip in the

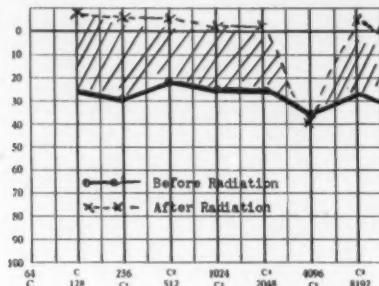


Chart 4. Mr. R. N.

audiogram was not clear. The patient worked as an electric welder (see Chart 4).

*Case 5:* Mr. J. M. with a carcinoma of the left vault noted hearing impairment in the left ear for four months before a diagnosis was made. The left drum was retracted, discolored and suggested the presence of fluid. The Weber test was referred to that ear. Immediately after receiving 4,150 R to this area in 46 days, the drum regained a normal appearance and the audiogram was improved. A high tone loss was present in both ears before radiation and this was not affected by radiation. His work as a steel chipper probably indicated that this high tone loss was

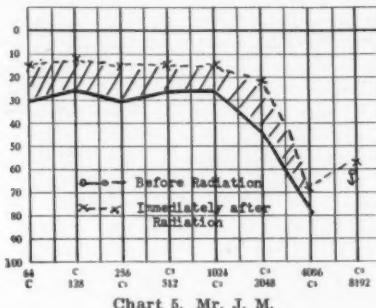


Chart 5. Mr. J. M.

due to acoustic trauma. With recurrence of his carcinoma, the exudative catarrh in his left ear returned and the functional tests returned to their initial values (see Chart 5).

*Case 6:* Mr. M. W. had a lymphosarcoma occluding the right tube. Deafness was noted to develop gradually in the right ear for three months before diagnosis was made. The right drum showed the typical findings of exudative catarrh. The Weber was referred to the right but the audiogram showed a greater loss for high tones, often seen with fluid in the

middle ear. After radiation therapy, the nasal obstruction was relieved and the ear was improved (see Chart 6).

*Case 7:* Mr. D. G. had an epithelioma occluding the right tube. There was a long history of deafness and nasal obstruction. A year previous to our examination, a myringotomy and inflation had been followed by temporary improvement. The drum was dull, retracted and suggested

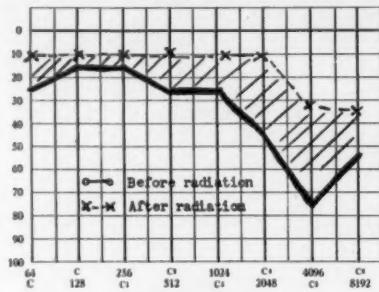


Chart 6. Mr. M. W.

middle ear changes as by fluid and thickened mucous membrane. The cells of the right mastoid were clouded on X-ray examination. The Eustachian cushion could not be visualized and the tube could not be inflated either by a +16 cm. of mercury air pressure during swallowing or by catheter. The Weber was referred to the affected ear and the Rinne was equal with a 512 cycle fork. Towards the end of his Roentgen ray treatment

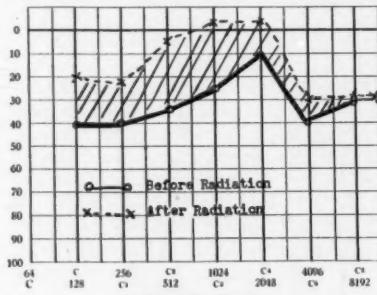


Chart 7. D. G.

of 5,250 R in 43 days, the drum perforated and for several days serous discharge was noted coming from a small central perforation. This healed in a week and the hearing was improved subjectively and objectively. A free airway through the right nostril was noted by the patient for the first time in over a year. The right tube could now be inflated by 6 cm. of Hg. air pressure during swallowing and definite maintained improvement of function was noted in the audiogram. Irreversible changes affecting the mass and stiffness of the conducting mechanism may have resulted from the long-standing lesion to prevent restoration of the threshold curve to the zero level (see Chart 7).

*Case 8:* Mr. J. G. had a carcinoma of the right vault for six months before diagnosis. The deafness was present for about four months. Two

months after the onset of deafness, a mastoidectomy had been done without lasting improvement of hearing or severe trigeminal pain. The drum changes were not clearly defined when first examined at this clinic but a frank conduction deafness was present in the right ear. Two audiograms of this ear taken five days apart at the onset of therapy were very similar and the Rinne test was negative upon examination. Five months after receiving 5,650 units of Roentgen rays through the right ear in 49 days, the ear appeared normal and a normal threshold was obtained (see Chart 8).

**Summary:** Conduction deafness due to long-standing severe tubal obstruction and associated middle ear changes of exudative catarrh associated with carcinoma of the nasopharynx can be completely reversed by radiation. Dryness of the

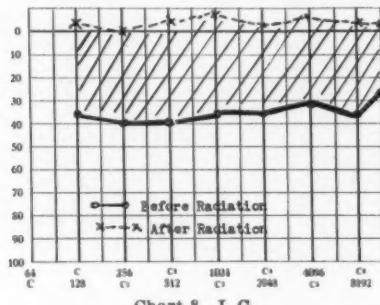


Chart 8. J. G.

mucous membrane in the vault was severe immediately after radiation but became less marked. Impairment of the function of the secretory cells by radiation probably extended to involve the secretory cells in the glands along the Eustachian tube. No other cellular injury, excluding that to the carcinoma itself, was evident. No detrimental effect on the various structures of the peripheral auditory apparatus could be found. On the contrary, uniform reversal of the middle ear pathology and the hearing impairment associated with tubal obstruction was observed.

#### *C. Effect of Radiation on the Injured Ear.*

There are few experimental studies on the effect of radiation on bone repair. Brooks and Hilstrom<sup>5</sup> report no effect on bone repair after one dose of 1,125 R but observed retardation of bone growth at the exposed epiphyseal end. Holmgren<sup>6</sup> reports reduced osteogenesis in labyrinth fistulas by use of radium. The problem was studied in this laboratory on

the rabbit cochlea. The injury consisted of a clean perforating lesion of the cochlea made under sterile precautions. After the lesion was made, the cochlea was exposed to measured amounts of Roentgen radiation and the animals were sacrificed at various intervals. The bones were then removed and serially sectioned.

Previous observations on the healing of clean perforating lesions of the labyrinth capsule<sup>7</sup> served as a control against

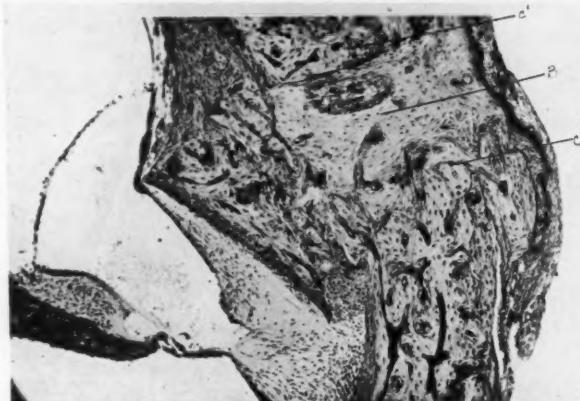


Fig. 1. Photomicrograph (X55) of a 30-day-old nonirradiated perforation of the cochlear capsule showing complete bony closure (B) of the defect between C<sup>1</sup> and C<sup>2</sup>.

which the findings in these radiated animals could be compared (see Fig. 1). One month after radiation with 1,500, 3,000 and 5,000 R, a perforating lesion shows definite delay in osteogenesis over the control (see Figs. 2 and 3). One year after radiation with 1,500 units of X-ray, complete closure of the perforation by bone was seen as in the control animals (see Fig. 4). An interesting finding in these perforated cochleas was atrophy of the stria vascularis for some distance along the cochlear duct adjacent to the perforation. This was present in both the radiated and nonradiated animals and must be considered as resulting in some manner from the perforating injury of the cochlear duct.

**Summary:** Only temporary delay in the healing of a clean perforation of the cochlea can be obtained by radiation with 1,500 units to 5,000 units of Roentgen rays.

No permanent arrest of osteogenesis could be obtained by radiation with 1,500 units of Roentgen rays and one year after radiation the perforation was found to be completely closed by new bone. No other effect of radiation on the injured labyrinth capsule or contained end-organs was noteworthy.

#### CONCLUSIONS.

1. The normal peripheral auditory apparatus can withstand massive radiation by Roentgen rays without structural or



Fig. 2. Photomicrograph (X80) of a 30-day-old perforation of the cochlear capsule exposed to 5,000 units of Roentgen rays showing delayed osteogenesis. Defect between C<sup>1</sup> and C<sup>2</sup> filled with connective tissue. (S) is a medially displaced fragment of cochlear capsule about which there are no signs of new bone formation.

functional impairment. The rate should not exceed 15 R per minute and 300 R per day.

2. Conduction deafness of many months' duration due to carcinoma with resulting tubal obstruction and exudative catarrh can be completely relieved by Roentgen radiation.

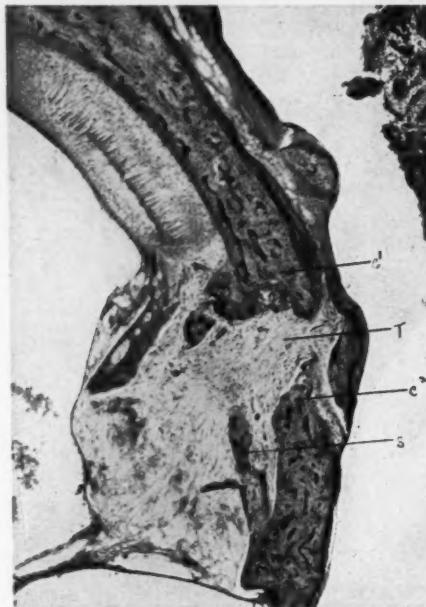


Fig. 3. Photomicrograph (X70) of a 7-week-old perforation of the cochlear capsule exposed to 1,500 units of Roentgen rays showing delayed osteogenesis. Defect in cochlear capsule between  $C^1$  and  $C^2$  is filled with connective tissue (T). Some signs of osteogenesis can be made out around the displaced spicules of capsule bone (S).

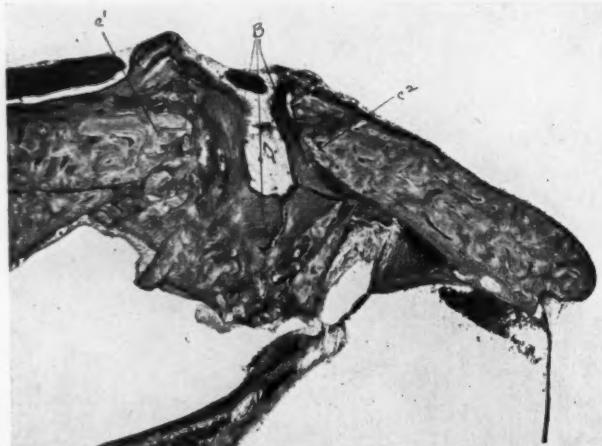


Fig. 4. Photomicrograph (X70) of a year-old perforation of the cochlear capsule exposed to 1,500 units of Roentgen rays showing new bone (B) closing defect between  $C^1$  and  $C^2$ .

The massive but carefully spaced dosage of radiation to which the ear is exposed does not injure the auditory apparatus.

3. The healing of clean perforations of the labyrinth capsule can be delayed but not prevented by radiation of the ear with 1,500 units of Roentgen rays.

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950 East 59th Street.

## MUCOSAL CYSTS OF THE MAXILLARY SINUS.<sup>†</sup>

GERHARD D. STRAUS, Capt., M.C., AUS.\*

One of the major diagnostic problems in military as well as civilian practice is the patient who presents himself with the complaint of persistent or intermittent headaches. These headaches are frequently of a vague or nondescript nature and often do not fit into the picture of any classical clinical syndrome. This symptom is of particular importance to the otolaryngologist since sooner or later, unless some other gross cause for the complaint is apparent, the patient will gravitate to him.

It is my purpose to discuss one of the causes for these headaches that is not apparent in a general examination of the patient or in a casual or hasty rhinological examination. Mucosal cysts of the maxillary sinus are a relatively common affliction and are frequent malefactors in producing this symptom.

Cysts of the antrum may be classified into two general classes: *A.* those of dental origin; *B.* those of mucosal origin.

*A. Cysts of Dental Origin:* Of these, there are two main types: *a.* dentigerous cysts — these are developmental in origin, arise from the tooth follicle and are characterized by a heavy fibrous or bony wall lined with stratified epithelium and contain a tooth or a rudimentary part of a tooth, usually the crown; *b.* radicular cysts — these develop from infected granulation tissue on the apex of a tooth root and push into the antrum, sometimes filling it completely. Mac Gregor<sup>1</sup> believes that these have their primary etiology in cell rests which proliferate under the stimulation of infection. Both of these types may cause bulging of the sinus walls and deformity. They are relatively easy to diagnose by careful history, dental and rhinological examination, and Roentgenogram.

<sup>†</sup>From the Otolaryngologic Service, Army Air Force Regional Station Hospital, Chanute Field, Ill.

\*Clinical Instructor, Department of Otolaryngology, Marquette University School of Medicine (on leave of absence).

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*B. Mucosal Cysts:* These develop in the sinus mucosa and fall into two general groups: *a.* the secretory type — this is thought to be due to the plugging of a mucus gland duct and distention of the gland with mucus (see Fig. 1). It is probably initiated by an acute infection and may be contributed to



Fig. 1. Low power photomicrograph showing an early stage in the formation of a secreting type of mucosal cyst. Note the immensely dilated mucus gland and the surrounding inflammatory reaction. The gland cells show an abnormal amount of secretory activity. This could account for abnormalities in the consistency of the fluid.

by a failure of adequate ciliary action in the ducts, due to damage of the cilia by the inflammatory process. This may cause a dilatation of the gland with eventual thinning out and destruction of the epithelial lining; *b.* the nonsecreting or mesothelial type of cyst. It is postulated by Mac Gregor<sup>1</sup> and Lindsay<sup>2</sup> that this is caused by damage to capillary walls

by infection which results in the loss of protein into the tissue spaces of the sinus mucosa raising the osmotic pressure of the interstitial fluid which in turn causes the pouring out of fluid into the tissues. This causes pressure on the lymphatics resulting in more retention of fluid, and since there is no muscle tissue to aid in fluid movement this process may continue until the fibrous tissue strands between the fluid are broken down and there is definite formation of a cyst (see Fig. 2). There is no epithelial lining to the wall. The outside is covered with typical respiratory epithelium and the inside by fibrous tissue, which in some cases may be rather

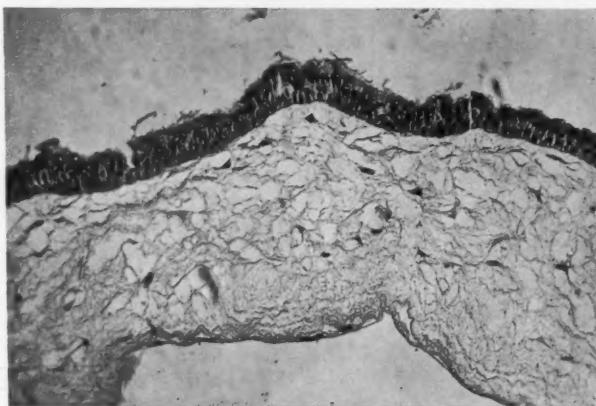


Fig. 2. Highpower photomicrograph of a nonsecreting cyst wall. Note the widely distended fluid spaces between fibrous tissue fibres. The epithelium is the outer layer of the cyst wall.

thick and dense (see Fig. 3). These cysts are filled with a transparent, clear, yellow or amber fluid which has almost the same chemical composition as blood serum and can be classified biochemically as an exudate.<sup>3</sup>

Mac Gregor and Lindsay believe rather firmly that these two entities developing in the maxillary sinus mucosa are sharply demarcated clinically by the type of fluid found at operation or by puncture with the antrum needle; the secreting type having a mucoid fluid and the nonsecreting type a clear serous fluid. In the series of cases here reported, while as a rule the findings concurred with this idea, there were some cases which had the typical fluid of nonsecreting cysts,

yet the histological study of the operative tissues showed a definite epithelial lining to the wall. At least one other such case has been reported.<sup>4</sup> This can be accounted for by a disturbance in the normal secretory activity of the glands by infection with an alteration of the secretion.

The cyst fluid in the nonsecreting type of cyst has been proven repeatedly to be sterile, and at operation there is usually no gross evidence of active inflammatory reaction. In spite of this, Lindsay<sup>2</sup> has reported several cases of infectious arthritis which cleared up on surgical removal of the cysts.

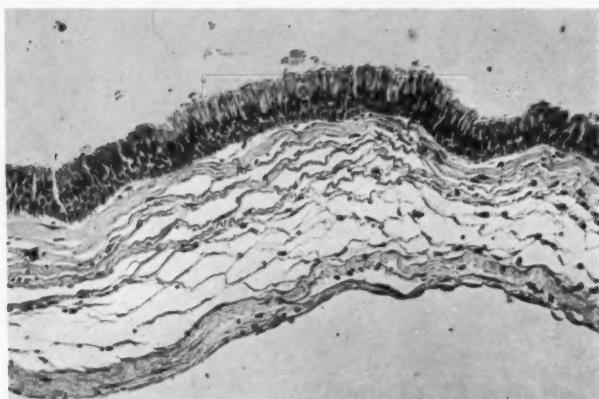


Fig. 3. High power photomicrograph of the wall of a nonsecreting cyst. Fluid spaces can be seen between the fibres of connective tissue. Thickening of fibrous tissue can be seen in the inner surface of the cyst wall. The epithelium is the outer layer of the wall.

James<sup>5</sup> has reported a case of "epilepsy" being cured by the removal of a mucoid cyst of the antrum. That the nonsecreting cyst may be a focus of toxic absorption seems to be borne out by the following case:

A 21-year-old soldier was admitted to the Army Air Force Regional Station Hospital, Chanute Field, on Jan. 4, 1944, because of a blurring vision of the right eye of one week's duration. Examination by Major C. H. Stoner revealed the following ophthalmological findings: "There is an edema of the optic disc with an elevation of about 1 diopter. The retinal vessels are engorged and there is considerable cloudiness of the vitreous surrounding the disc. The visual fields are normal. The visual acuity is 20/25 in the right eye and 20/15 in the left eye." A diagnosis of optic neuritis was made and a careful search for a focus of infection was carried out. This was negative except for the finding of the presence of small cysts in the right maxillary sinus by Roentgenogram. Routine treatment with homatropine, bed rest and chemotherapy produced no

remission in the findings. A radical antrum operation (Caldwell-Luc was performed on Jan. 21, 1944, and two small nonsecreting cysts were found and removed. The neuritis began to subside on the second postoperative day and the patient completely recovered in 10 days, the visual acuity in the right eye having returned to 20/15.

Whether this is a fallacy of "post hoc, ergo propter hoc," is certainly a matter for debate, but in view of this case and those reported by James and Lindsay, I believe that one should look for and remove these cysts as a possible toxic focus in

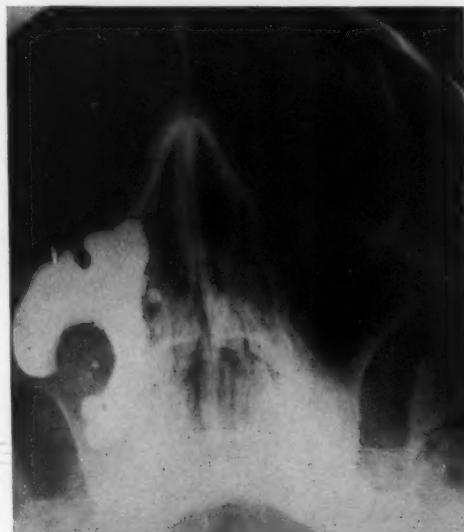


Fig. 4. Sinus Roentgenogram in Waters' position with iodized oil filling the right antrum. Globular filling defect on lateral wall proved at surgery to be a mucosal cyst of the maxillary sinus. Notch in superior portion of sinus is the canal for the infraorbital nerve.

those conditions whose etiology may be focal infection, although there has been no clear explanation for a sterile cyst being the cause of this pathology.

Mucosal cysts may be single or multiple and frequently are multilocular. They may occur on any of the antral walls, usually the inferior, and may vary in size from that of a pea to those that fill the entire sinus. They rarely, if ever, cause bulging of the bone of the sinus walls. The mechanism of the causation of pain especially in the case of the smaller cysts is a matter for conjecture. It may be due to pressure on or

tension of the mucoperiosteum from which they originate. In cases where there is complete filling of the sinus the pain is probably due to pressure on the sinus walls.

The symptoms of this disease may vary from the typical maxillary sinus syndrome to vague aches and pains of varying intensity and duration about the head. The most common symptom is a simple recurrent or persistent frontal headache. Occasionally there is concurrent aching of the homolateral



Fig. 5. Lateral view of sinuses, iodized oil having been instilled into the antrum. Large filling defect on floor of the maxillary sinus can be clearly seen. Fig. 7 shows exposure of these cysts at surgery in this patient.

upper teeth and a sensation of pressure in the cheek. The headache is usually unilateral but may occasionally be bilateral. These patients rarely complain of nasal discharge unless there is also an active rhinitis or sinusitis present.

Anterior and posterior rhinoscopy usually reveals no findings. In one patient, however, a thin membranous sac which at first glance had the appearance of a globule of pus, was seen dependent from the middle meatus over the inferior turbinate. Rupture of the sac revealed the characteristic fluid of the antral cyst. Transillumination of the antra is unreli-

able in the diagnosis of this disease, because a good transmission of light usually occurs, as the cyst fluid in the mesothelial cyst is transparent.

Roentgenograms of the sinuses reveal two general types of findings. In some cases one can see the outline of a discrete rounded soft tissue mass within the sinus. In this instance the diagnosis is quite apparent. More commonly, however, the findings are that of fluid within the antrum similar to that of a sinusitis. In these cases the next common procedure



Fig. 6. Anterior-posterior Roentgenogram of the sinuses. Iodized oil can be visualized between cysts on the medial and lateral walls of the maxillary sinus.

is the diagnostic antrum puncture through the inferior meatus. This will reveal one of two findings: in some cases the characteristic fluid will run out of the antrum needle and the diagnosis is evident, in other cases there is no spontaneous flow of fluid and one proceeds to a routine irrigation of the antrum. The antrum wash is free of pus and clear fluid is returned. In this clinic in cases where there is Roentgenological evidence of sinus disease and a negative antrum lavage, iodized poppy seed oil is instilled into the sinus through the inferior meatus needle and routine sinus Roentgenograms are taken, plus one lateral view with the head held far back

to allow the oil to flow into the posterior superior portion of the sinus. These films will show typical filling defects and will give one valuable information as to the size, number and location of the cysts (see Figs. 4, 5 and 6).

Three methods of treatment have been advocated: The first is puncture of the cysts and evacuation of its contents with an antrum needle. This is unsatisfactory because some cysts are multilocular and others are multiple, and still others are in position that is extremely difficult to reach under ordinary circumstances. In cases where the cyst contents have been evacuated in this fashion the usual experience is that they refill and the patients have a recurrence of symptoms



Fig. 7. View of the cysts in situ. Exposure of the maxillary sinus by Caldwell-Luc operation. Arrows indicate cysts on the floor of the sinus. Fig. 5 shows the preoperative Roentgenograms on this patient.

within one to three months, and more radical procedures are necessary to affect a cure.

The second method advocated is that of an intranasal antrum window resection with removal of the cyst or most of its wall. This method has proven successful in some hands, but would seem to be inadequate for many cases, especially for small cysts originating in the lateral wall and where adequate visualization cannot be obtained through the window.

The last and most acceptable, perhaps, for most cases is the radical antrum operation (Caldwell-Luc) which affords a

clear unobstructed view of the sinus walls (see Fig. 7) and allows one to remove the cyst as atraumatically as possible. It is important that the unaffected sinus mucosa receive no trauma, as in most cases it is grossly normal. In those few cases where the cyst is part of a well defined chronic inflammatory disease of the mucosa one should proceed with a complete removal of the sinus membrane. With adequate pre-operative medication the operation is satisfactorily done under local anesthesia with particular care being taken to block the infraorbital nerve at the infraorbital foramen. The classical sublabial incision is made and the periosteum over the anterior wall of the sinus is elevated, avoiding as much tearing and trauma as possible. The anterior wall of the sinus may be opened with the Hudson drill or mallet and gouge. It is best that an inferior meatus counteropening be made into the nose to insure adequate drainage should the sinus become infected; however, where a single small cyst is removed and the sinus mucosa is not damaged, one may omit the window. Complete hemostasis within the sinus is desired and no packing or drains need be used. Pre- and postoperative swelling can be kept at a minimum by the avoidance of excessive trauma to the periosteum, especially by tugging the retractors. The after-care consists primarily of daily removal of secretions from the nasal passage with the suction tip. The patient will experience a complete cessation of symptoms following the operation.

In those patients where the diagnosis of cyst is made but where there is a question as to whether it is the cause of the headache, the puncture of the cyst through the inferior meatus may be attempted as a therapeutic test. In those cases where the symptoms are due to this disease the headache will sometimes disappear shortly after the fluid is withdrawn and will recur some time later as the cyst refills.

In this hospital 25 cases of maxillary sinus cyst have been seen in the last 10 months. Of these, 15 cases have been operated with the radical sinus opening. Fourteen of these were mucosal cysts and one was a follicular cyst containing a fully developed molar tooth. In one case an inferior meatus window was omitted, in the others the classical procedure was followed. All of the cases were cleared of their symptoms

and no cases of recurrence or resultant sinusitis were noted in those patients who could be followed up.

*Comment:* Attention is called to a common but sometimes obscure and neglected cause of headache and focal toxicity which can be easily diagnosed and treated. Mucosal cysts of the maxillary sinus must be considered in these conditions and eliminated surgically whenever they are found.

Note: I am indebted to Mr. Leo Massopust, of Marquette University School of Medicine, for the preparation of the photomicrographs.

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## TREATMENT OF EXTERNAL OTITIS.

### I.— LOCAL SULFONAMIDE THERAPY.

CAPTAIN BEN H. SENTURIA,

Randolph Field, Tex.

Throughout the humid tropical and subtropical regions, infection of the external auditory canal among Army Air Force personnel has become an important problem. The pilot with a mild external otitis may be grounded indefinitely; the member of a ground crew may be prevented from carrying on his routine duties; both may require hospitalization for the acute form of this infection.

External otitis occurs endemically throughout the southern United States during the warm seasons and appears in epidemic form from time to time in particular localities. Much disagreement exists as to etiology. Some workers emphasize the fungous origin of this condition.<sup>1,2,3,4</sup> Others<sup>5,6,7</sup> have reported series of cases in which the predominant flora has been bacterial. In routine studies of cases in Missouri and Texas, cultures grown on Sabouraud's agar and blood agar media have shown a mixture of fungi and bacteria. This is in agreement with a majority of the observations.

Bacterial cultures obtained from the normal surface epithelium frequently show *staphylococcus aureus* and *albus*, *streptococcus hemolyticus* and *viridans*, *bacillus pyocyaneus*, and *diphtheroids*. The *staphylococcus* may invade the hair follicles and sebaceous glands and produce a localized lesion extending into the dermis. The hemolytic *streptococcus* may disregard all epidermal and dermal demarcations and involve all the skin layers of the ear and of the periauricular tissues. Pure cultures of *streptococci*, *diphtheroids*, and *bacillus pyocyaneus* have been obtained from ear canals which show low grade chronic infections.

On routine cultures of normal external auditory canals, spores of *penicillia*, *aspergilli* and *monilia* have been obtained.

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Infrequently, other fungi have been cultured. Many references are available describing mycelia present in the wax removed from the apparently normal ear canal. Mycologists<sup>8,9</sup> point out that the fungi cultured from otomycotic infections are invariably saprophytic organisms which confine themselves to the surface epithelium and do not invade beyond the stratum corneum. True pathogenic fungi, *e.g.*, trichophyton, are rarely found in the external auditory canal.

Fungi have very definite growth characteristics. They are aerobic organisms and are able to utilize a variety of carbohydrates for their energy source. They will grow and flourish on ear wax and, under favorable conditions, will break down this complex substance into simple and readily available carbohydrates. Fatty and oily substances accelerate their growth. Moisture is necessary to obtain close contact between the organism and its food substrate. An acid medium favors more rapid and luxuriant culture growth.

In simple bacterial infections some interference with the local protective mechanism must take place in order to permit invasion of the epithelium. The instillation of water or moisture into the ear canal permits the ever-present fungus spores to gain close contact with the wax, debris or exfoliated epithelium. Mycelia grow into the nutrient media and enzymes are produced. These cause a further breakdown of the carbohydrates and permit a continued growth and spread of the fungi to contiguous parts of the canal wall. Metabolites or toxins are produced as byproducts which irritate the surface epithelium. Bacteria which are present then penetrate the macerated surfaces and secondary spread of infection occurs. With these fundamental facts in mind, the mechanism of the infection becomes evident.

Patients with external otitis who are seen in the out-patient department may be grouped into three categories, *viz.*, those showing mild, moderate or severe signs and symptoms. The *mild* case may report having a feeling of blockage of the ear, dryness, itching, scaling or mild tenderness on manipulation of the auricle. *Moderate* cases have definite pain on movement of the auricle, some edema of the canal wall and early evidence of periauricular adenopathy. The *severe* external otitis case shows complete edematous obstruction of the canal with secondary periauricular edema. This

patient may have a slight elevation of temperature, is unable to sleep and will not eat because movement of the temporo-mandibular joint causes displacement of the hypersensitive fibrocartilaginous canal.

The subject with the severe fulminating external otitis may show both a bacterial and fungous growth when cultures are taken. The patient with mild symptoms of blocked ear and only a suggestion of discomfort on manipulation of the auricle may demonstrate a pure culture of *Aspergillus niger*, *Staphylococcus albus* or *Bacillus pyocyaneus*. Seborrheic canals teem with *Staphylococci*. *Streptococci* are invariably cultured from ear canals containing purulent discharge.

#### SULFONAMIDES.

Considerable evidence has been accumulated indicating that the sulfonamides exert an effect *in vitro* as well as *in vivo*. Most authorities agree<sup>10,11,12</sup> that there is a direct action on the bacterium. In experiments performed *in vitro*, sulfanilamide demonstrated very poor bactericidal action against hemolytic streptococci. If whole blood is added to the medium containing a sulfonamide, improved bacteriostatic activity is obtained. If high concentrations of the drug are used in a medium unfavorable to the growth of the bacteria, bactericidal action is obtained against *Staphylococci* and certain Gram negative bacilli.<sup>13</sup> Recently, the bacteriostatic and bactericidal action of sulfathiazole against *Staphylococci* in defibrinated whole blood has been demonstrated.<sup>14</sup>

Some reports<sup>15,16</sup> have emphasized the importance of an oxidizing substance to activate the sulfonamides and to promote and augment the formation of hydrogen peroxide. This, it is pointed out, explains the three- to four-hour lag period required before the drugs show their effect in cultures. In various clinical studies, zinc peroxide, azochloramide, etc., have been combined with the sulfonamides with this purpose in mind.<sup>17</sup> The action of zinc peroxide against various micro-aerophilous and anaerobic organisms has been thoroughly investigated.<sup>18,19</sup>

Another group of investigators<sup>20,21</sup> have described the formation of an "anticatalase" by the action of an oxidizing agent upon the sulfonamides. This substance neutralizes the

action of catalase normally formed from the tissue substrate and permits the piling up of concentrations of hydrogen peroxide which are inimical to the growth of bacteria. Once bacterial reproduction ceases, the phagocytic defense of the body is usually able to cope successfully with the infection.

Sporadic clinical reports have described good results with the use of sulfonamides in various fungous infections.<sup>22,23</sup> In vitro experiments at the AAF School of Aviation Medicine have shown that only sulfanilamide, among the various available sulfonamides, exerts a fungistatic action upon organisms recovered from cases of acute otomycosis.<sup>24</sup>

#### CLINICAL APPLICATION.

Any one of the commonly used sulfonamides, applied locally, will inhibit the growth of practically all bacteria. Sulfathiazole is reported to be most efficacious against the staphylococcus. Sulfanilamide has been shown to have a specific fungistatic action. Consequently, sulfanilamide or sulfathiazole powder was applied in the earlier cases. Latterly, a mixture of sulfanilamide, sulfathiazole and zinc peroxide powders (4:2:2) was used in an effort to increase the effectiveness of the drugs against all bacteria and fungi. In the event that the powdered sulfonamide is not available, the tablet may be readily pulverized with the back end of the plunger of a glass syringe. Crystalline sulfanilamide is difficult to apply to the constricted external auditory canal and should not be used.

Insufflation of the powder into the ear canal is best accomplished by a commercial powder blower. Where such apparatus is not available, an ordinary cork stopper, or wooden block, may be improvised as an insufflator. An opening 1 to 2 cm. in diameter and approximately 2 cm. deep is cut into the upper flat surface. A discarded No. 20 syringe needle may be heated and inserted into the sides of the cork, or openings bored into the block, in order to make two channels which enter opposite sides of the excavated center approximately 1 cm. from the top. Pieces of ordinary 4 mm. coated sleeving, aircraft insulation, or glass tubing approximately 5 to 7 cm. long are inserted into the channels and serve well for the required inlet and outlet. By placing the index finger over the top opening and blowing gently into the afferent

tube, a thin cloud of powder may be insufflated through the efferent pathway into the ear canal.

Removal of the adherent powder from the ear canal and tympanic membrane need not present a difficult problem. Irrigation with a solution made up of one to two teaspoonfuls of sodium bicarbonate per glass of warm water will loosen most of the dried powder. If an irrigation setup is not available, hydrogen peroxide may be used. The patient rests his head on a table so that the infected ear is upward. Peroxide (3.5 per cent) is instilled with a medicine dropper and the fluid actively circulated through the ear canal. On contact with the debris in the canal, the solution liberates oxygen bubbles that mechanically loosen the adherent powder which floats to the surface.

Other less available solvents such as propylene glycol, glycerine, etc., have been tested and will slowly loosen the powder from the canal wall. Ethyl alcohol (70 per cent) will cause severe burning if applied before the third or fourth day of treatment. When water or hydrogen peroxide is used, it is essential to dry the canal carefully or to utilize 50 per cent or 70 percent alcohol in order to remove thoroughly all moisture from the ear canal.

Idiosyncrasy to the local use of sulfonamides has been reported.<sup>17</sup> This has been described as consisting of angry, red, raised areas, and may be accompanied by a diffuse papular rash or a moist eczema. No conclusive evidence has been presented to indicate development of sensitivity after the use of small amounts of sulfonamide locally. If, in an individual case, a sensitivity to the oral ingestion of one sulfonamide has arisen, another should be substituted for local application.

#### METHOD OF TREATMENT.

A majority of the medical officers observing these infections will have had only a short period of otologic training, and could not be expected to visualize and treat the less accessible portions of the ear canal. Consequently, in this series of cases no effort was made to clean carefully or to dry that portion of the auditory canal internal to the isthmus. The powdered form of sulfonamides was used in most of the treatments. Cultures were taken in occasional cases to confirm

the clinical impression of predominant fungous or bacterial infection. Patients were seen daily until recovery occurred and then at weekly intervals for a month thereafter in order to examine for possible changes in the tympanic membrane, to check auditory acuity, and to observe any tendency toward recurrence of infection.

Routine treatment consisted of the following: Hydrogen peroxide (3.5 per cent) was applied to all the exposed and easily accessible parts of the concha and external auditory canal. Any debris or wax which could readily be seen was gently removed with a cotton applicator without traumatizing the inflamed surface epithelium. A small ear speculum was inserted carefully into the canal and powdered sulfonamide insufflated lightly over the canal wall. The speculum was removed and the concha was then coated with the drug. The patient was given sufficient analgesic and sedative to assure a comfortable night's rest and advised to use only dry, warm applications. He was instructed to report the following day.

Upon return, after an interval of 18 to 24 hours, the mild case reported complete relief from pain. This was particularly striking where fissuring of the canal was present. The moderate case showed a decrease in the edema, drying of the discharge and an improvement of subjective symptoms. The severe case had obtained a *definite* decrease in the amount of discharge, and some relief of pain and edema. A much greater degree of co-operation was now obtained from the patient so that more extensive cleansing and application of hydrogen peroxide was possible. A larger speculum could be inserted which permitted a deeper insufflation of powder.

On the second to fourth day, depending entirely upon the severity of the infection and the response to treatment, the ear canal was irrigated with a warm 1 per cent to 3 per cent solution of sodium bicarbonate to remove all the accumulated debris. It is important that this irrigation be performed only when the infection and edema have subsided sufficiently so that the water can be removed and the canal dried. Following this, 50-70 per cent alcohol was applied with a medicine dropper, allowed to remain in the canal for several minutes, and removed by gravity drainage. Any residual alcohol in the canal quickly evaporated. Powder was reapplied and

allowed to remain in the canal for one week. The patient was cautioned against the use of water in or about the ears and swimming was forbidden for the following two weeks. All adherent powder was subsequently removed by irrigation.

#### RESULTS.

For purposes of comparison and evaluation, all cases (ears) were divided into three groups: 1. those which showed mild, moderate or severe infections and were treated by the sulfonamide powder technique; 2. those which demonstrated similar findings but were treated by some other standard regime; and 3. those infections which were of long duration, showed evidence of chronic irritation (eczematoid) and required other medicaments to supplement the powder insufflation technique.

Sixty-four cases (ears) of external otitis were seen at Randolph Field, Tex., during the summer of 1943. All cases

TABLE 1.  
DATA SHOWING THE RESULTS OF LOCAL SULFONAMIDE THERAPY IN  
64 CASES (EARS) OF EXTERNAL OTITIS.

	Total No. of Ears	Days Required for Relief of Pain or Discomfort				Days Required for Complete Cure		
		One Day	Two Days	Three Days	Greater Than 3 Days	Seven Days or Less	Greater Than 7 Days	
1. Acute ears treated by powder insufflation.....	33	12	11	7	3	32	1	
2. Acute ears treated by other procedures.....	19	2	3	2	12	11	8	
3. Chronic eczematoid ears treated by powder in- sufflation and supplement- ed by other procedures.....	12	0	1	0	11	1	11	

Comparison of the time required for relief of pain and complete cure among cases treated by the sulfonamide powder insufflation technique and by other procedures.

were referred from the station hospital and were accepted regardless of chronicity or severity. In cases showing comparable bilateral involvement, one ear was treated with sulfonamide powder insufflation and the other with dry wipes or alcohol, in an attempt to set up a control. Every effort was made to obtain accurate records of the time required for relief of pain and itching and the number of days necessary for complete cure. Thirty-three ears with acute external otitis were treated by the sulfonamide insufflation technique (see Table 1). Twelve of these cases were relieved of pain

in one day, 11 in two days, and seven in three days. Only three patients required more than three days for relief of discomfort. Only one case out of the entire 33 in this group required more than seven days for complete cure.

Nineteen ears with similar acute infections were treated with dry wipes, alcohol (70 per cent), and sulfanilamide in alcohol. Of this number, two were relieved of pain in one day, three in two days, and two in three days. Twelve required more than three days. For complete cure, a little more than half of the total number required seven days or less, while the remainder required more than seven days.

Twelve ears were included in the category of chronic eczematoid infections and received the sulfonamide powder therapy. With one exception, these cases responded poorly to treatment. Some relief of chronic itching was reported in

TABLE 2.

Case No.	Ear Treated by Sulfonamide Powder Insufflation			Control Ear			Remarks
	Days for Relief of Pain	Days for Complete Cure	Days for Relief of Pain	Days for Complete Cure	Control Treatment		
1	1	4	2	4	Dry wipe		Recurrence in control ear
2	2	2	9	12	Sulfanilamide in alcohol		
3	1	2-3	3*	3*	Alcohol		*Patient transferred
4	3	3	5	8	Alcohol		
5	2	4	2	2	Alcohol		Recurrence in control ear

Comparison of five cases who presented bilateral acute external otitis (10 ears). In each case one ear was treated by the sulfonamide powder insufflation technique and the other was used as a control.

two cases and complete cure was eventually obtained in four ears after prolonged and varied therapy.

Five patients co-operated in allowing one ear to be used as a control while the other ear was treated by the sulfonamide insufflation technique (see Table 2). It is evident that in four of the cases relief of pain and complete cure was somewhat more rapid. Of equal importance, however, are the two recurrences which occurred in the control ear. Not a single recurrence occurred in the entire series of 33 cases treated with the sulfonamide powder technique.

No sensitivity or idiosyncrasy to the powdered sulfonamide was found; however, three ears developed hemorrhagic blebs

and serosanguineous discharge following the use of an alcoholic solution of sulfanilamide. No evidence of local irritation, ulceration or keratinization of the tympanic membrane was observed. Auditory acuity was unaffected.

#### CONCLUSIONS.

1. Forty-five ears showing acute and chronic external otitis were seen over a period of four months, and were treated with sulfanilamide, sulfathiazole, or a mixture of the sulfonamides and zinc peroxide.
2. In the majority of the 33 cases of *acute* external otitis treated by insufflation with sulfonamide powder, relief of pain, drying of discharge and subsidence of edema occurred in one to three days. Complete cure of the infection required five to seven days.
3. A clinically similar group of 19 cases was treated by other conservative procedures and required a longer period of time for relief and cure.
4. Uncomplicated cases of recent origin were cured promptly and did not recur following the use of the sulfonamide insufflation technique. Chronic eczematoid external otitis (neurodermatitis) did not respond to this form of therapy.
5. No evidence of local irritation or idiosyncrasy to the sulfonamide powder was seen during the period of observation.
6. On the basis of observed experimental and clinical findings, a simple and practical technique for handling these infections is described.

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## A MIXED TUMOR OF THE NASAL SEPTUM.

### REPORT OF A CASE.\*†

MATTHEW S. ERSNER, M.D., and MAURICE SALTMAN, M.D.,  
Philadelphia.

A mixed tumor of the nasal septum is of rare occurrence. The first description of this rarity is to be found in Denker and Kahler's *Handbuch*,<sup>1</sup> which was published in 1929. Only two cases of a mixed tumor springing from the nasal septum are recorded in the American literature. The first was reported by Stevenson<sup>2</sup> in 1932, and the second by Weidlein<sup>3</sup> in 1936.

In our patient, the encapsulated mixed tumor lay mesial to the septum and extended laterally toward and through the middle meatus, pushing outward the frontal process of the superior maxilla.

Our case, therefore, constitutes the fourth instance wherein this type of neoplasm is recorded in medical literature.

### REPORT OF CASE.

*Case 1:* P. G., male, aged 19 years, was admitted to the Temple University Hospital, Jan. 11, 1944. His chief complaint was inability to breathe through the right side of the nose and the presence of a protuberance on the external and lateral portion of the nose on the same side. About a year prior to admission, he noted a slight fullness over the crest of his nose. This swelling gradually increased in size, but otherwise he had no discomfort.

His family history was irrelevant, other than the ordinary diseases in childhood and a herniorrhaphy in 1936. There was no history of injury to the nose.

Physical examination disclosed no abnormalities, with the exception of a hard mass, the size of a chestnut, which was present on the right side of the nose.

Rhinoscopically, the right nostril was found to be obstructed by a tumefaction in the space between the middle meatus and the septum, with complete obstruction of the anterior end of the inferior turbinate.

A thin probe could readily be inserted into the inferior meatal region, but there was complete obstruction between the mass and the septum.

\*From Temple University School of Medicine.

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The mass was hard, smooth, did not pit on pressure, nor did it respond to shrinkage.

Nasopharyngoscopic examination through the left naris did not disclose any mass in the nasopharynx. We were unable to pass the scope through the right side of the nose because of the growth. The posterior portion of the septum and the inferior turbinates were visible in the postnasal mirror.

Transillumination revealed cloudiness of the right ethmoids.

Laboratory Findings: The urine and blood were normal. The Wassermann was negative.

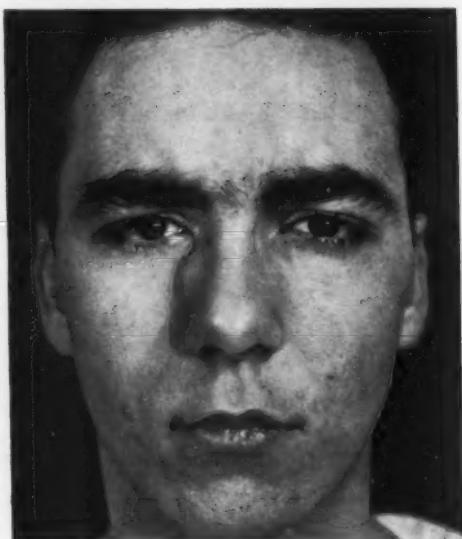


Fig. 1. External view of protuberance.

Provisional X-ray diagnosis was that of an osteoma of the right nasal bone and frontal process of the superior maxilla; however, further studies disclosed the mass to be a mixed tumor.

Because of the provisional X-ray diagnosis of osteoma and the physical appearance of the mass, no attempt was made to puncture the mass with a needle; however, one should profit by this experience, and, as a matter of routine procedure, should do a paracentesis with a needle where there is a suspicious mass, regardless of the provisional diagnosis. Such action will definitely help to determine the nature of the growth. Roentgenologic findings were as follows, quoting the X-ray report verbatim: "Region: Nasal accessory sinuses and facial bones.

"The X-ray appearance of the facial bones is extremely interesting because there is a soft tissue tumor or cyst which is distorting the right nasal bone and the frontal process of the right maxillary bone. The Waters projections of the sinuses show very clearly the lateral expansion of these bones (see Fig. 2).



Fig. 2. Waters projections of the sinuses showing the lateral expansion of these bones.

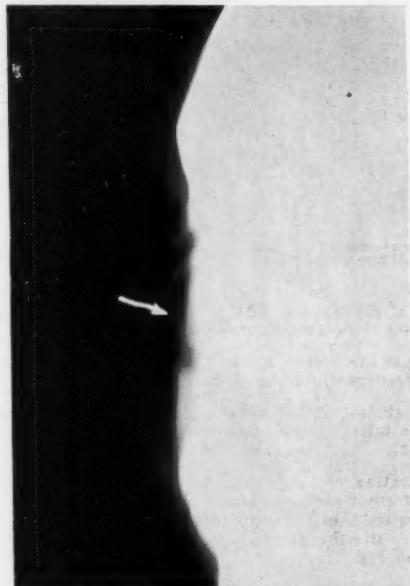


Fig. 3. Planigraphic study demonstrating a fairly large tumor in the right naris.

"The soft tissue Roentgenograms of the face and nose show that the soft tissue tumor lies mesial to the inferior aspect of the left nasal bone and protrudes slightly below its inferior margin.

"There is evidence of disease in the ethmoids on the right and in the right frontal sinus due to block by the cyst or tumor.

"Conclusions: A soft tissue mass of some sort, either a benign tumor or a cyst, was demonstrated. This lesion was expanding the right nasal bone and displacing it laterally, and we believe was also involving the



Fig. 4. This figure suggests that the periphery of the mass is composed of either bone or calcium.

frontal process of the right maxilla. Naturally a biopsy was indicated in order to determine the true nature of the lesion."

The following is the report of the planigraphic examination of nose to supplement conventional studies as carried out previously:

"Planigraphic studies of the nose were carried out in order to demonstrate better the fairly large tumor or cyst that is present in the right nostril (see Fig. 3).

"The demonstration of this tumor or cyst is quite satisfactory, and a good deal of information is obtained by studying the Roentgenograms. There is a suggestion that the periphery of the mass is composed of either bone or calcium while the central area appears to be made of soft tissue of some sort (see Fig. 4).

"We still cannot determine the nature of the tumor but feel that it is

entirely benign and is of significance only because it is expanding the naris and displacing the right nasal bone in a lateral direction."

The following operation was performed (Jan. 11, 1944): Block and infiltration anesthesia were used to anesthetize the operative field on the right side of the nose. The infratrocchlear, external nasal, nasopala-

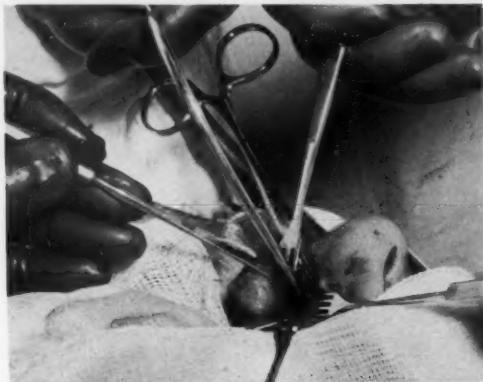


Fig. 5.

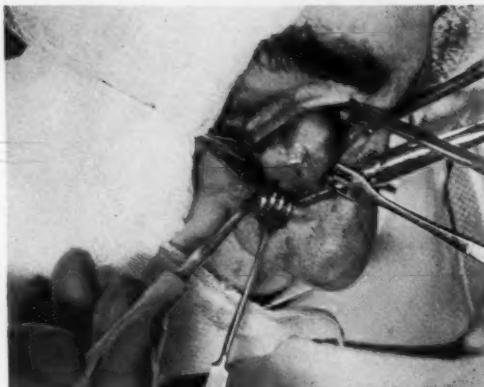


Fig. 6.

Encapsulated tumor partially and completely exposed.

tine, anterior palatine and the infraorbital nerve were blocked. Pledgets of cotton saturated with 2 per cent pontocaine in 1 per cent neosyn-ephrin constituted the topical anesthetic employed intranasally. A skin flap having been reflected, parts of the frontal process of the right superior maxilla and nasal bone were removed. The tumor, the size of a chestnut, was exposed and found to be encapsulated and mobile except for its attachment to the right side of the septum (see Figs. 5 and 6).

Upon dissecting the mass from the septum, the septal cartilage was found intact and not involved in the neoplastic process (see Fig. 7). The tear in the septal mucous membrane was repaired with catgut sutures, the procerus muscle and the periosteum were then closed with No. 00

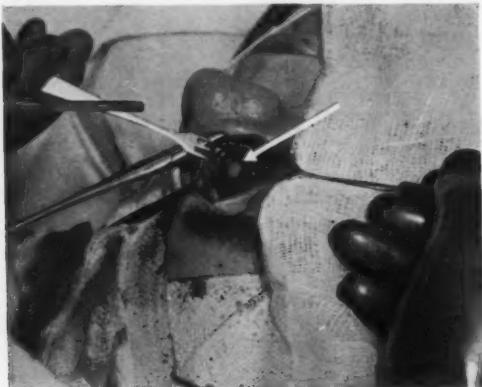


Fig. 7. Exposed septal cartilage showing where the tumor was attached.



Fig. 8. Denotes covering of the denuded septal cartilage with septal mucous membrane.

catgut sutures and the external wound was closed routinely with atraumatic silk sutures (see Fig. 8).

Convalescence was uneventful. Both the intranasal and external wounds healed promptly and a good cosmetic result was obtained (see Fig. 9).

**Gross Description of the Tumor:** The specimen was a spherical piece of tissue 3 cm. in diameter. It was moderately soft and almost completely encapsulated by a thin membranous layer except for one area

which was ragged and torn where it was detached from the septum. The cut surface had a grayish white, slightly granular appearance (see Fig. 10).

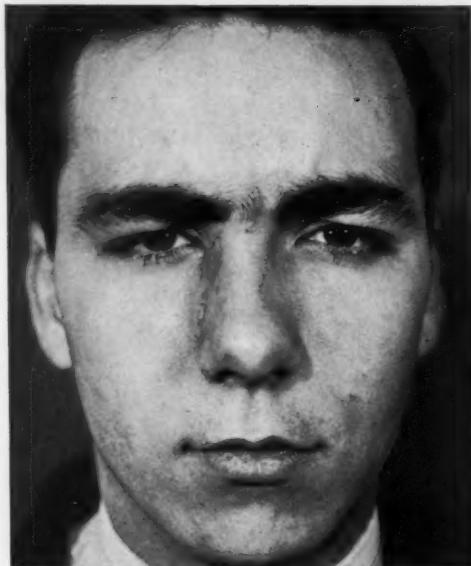


Fig. 9. Four weeks postoperatively showing good cosmetic result.

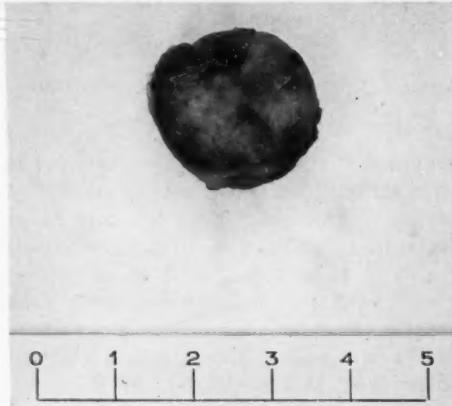


Fig. 10. Specimen of tissue 3 cm. in diameter.

**Histologic Description:** Multiple sections from representative areas revealed a most unusual picture. There was a neoplastic lesion composed

of collagenous stroma with cartilaginous areas and areas of myxomatous degeneration. Diffusely scattered throughout the stroma were numerous masses of epithelial-like cells. It tended to assume an acinar outline with lumina containing eosinophilic material. In other places the cells were compact and irregularly arranged. This picture of multiple tissue elements is much like that often seen in mixed tumors of salivary glands (see Figs. 11 and 12).

Diagnosis: Mixed Tumor.

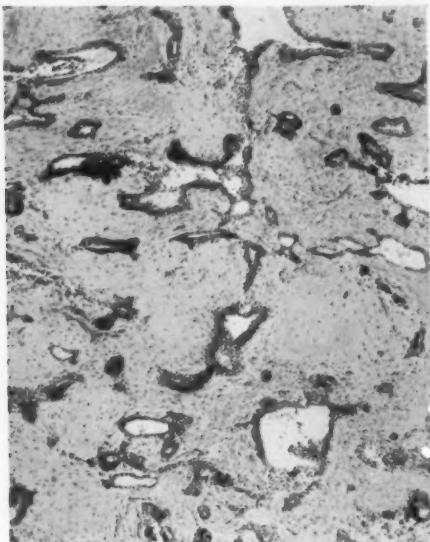


Fig. 11. (Low power) Microphotograph of tumor.

*Comment:* McFarland<sup>4</sup> states that the nature and origin of mixed tumors is uncertain; that the endeavor to correlate the histopathic structure of these neoplasms with their clinical behavior has failed. As they frequently arise from the acini and ducts of the parotid, these tumors have been designated "the salivary gland type." The aberrant location, such as the mucous membrane of the septum, probably results from implantation of misplaced embryonic cells. In the second month of fetal life when the nasal pits deepen and carry their ectoderm through the thickness of the mesoderm, cell displacement may take place during the course of this migration. Ewing<sup>5</sup> stresses the importance of the embryonic features in mixed tumors. The question of recurrence and

malignant degeneration depends upon the stage of maturity of the cells of a neoplasm. In McFarland's<sup>4</sup> statistics of 297 mixed tumors of the salivary glands, there was a recurrence of 23.23 per cent and a mortality of over 4 per cent.

Complete surgical removal with the capsule intact is the ideal treatment for a mixed tumor. Goldsmith and Ireland<sup>6</sup>

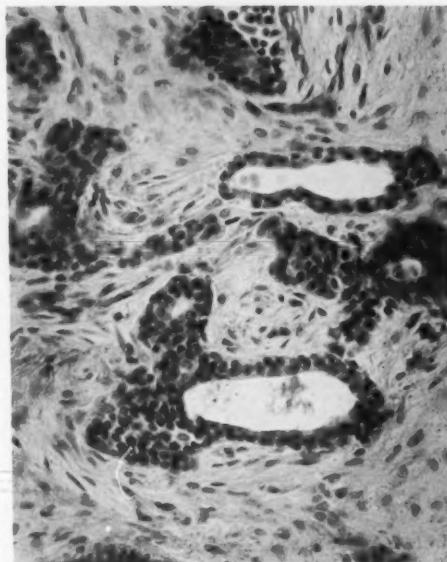


Fig. 12. (High power) Microphotograph of tumor.

obtained unsatisfactory results from primary radiation in a series of three cases of mixed tumor; however, these authors advise radiation postoperatively as a prophylactic measure against recurrence. Rhoads and Mecray<sup>7</sup> conclude that irradiation should be used postoperatively only in those cases in which the capsule is broken.

The importance of the integrity of the capsule is stressed by McFarland,<sup>4</sup> who advises against diagnostic biopsy lest tumor cells will be released and disseminated into the surrounding tissues.

## SUMMARY.

1. An encapsulated mixed tumor, the size of a chestnut, distorting the right nasal bone and the frontal process of the right superior maxilla, was removed in toto.
2. From 2 to 3 mm. of healthy mucous membrane of the septum adjacent to the mass was resected.
3. The septal cartilage appeared healthy and was, therefore, left undisturbed.
4. The mucous membrane of the cartilaginous septum was elevated and sutured, completely covering the denuded area.
5. No X-ray irradiation nor radium was employed because the mass was found to be encapsulated and was removed completely.
6. The external wound healed by primary union.
7. The septal wound was completely healed.
8. The patient, being observed postoperatively, once weekly, for five months, showed no evidence of any recurrence.
9. This case, the fourth in medical literature, illustrates that irradiation is not indicated where the mass is encapsulated and is removed in toto.

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## BOOK REVIEWS.

**Diseases of the Ear, Nose and Throat.** By Douglas G. Carruthers, M.D., Ch.M. (Sydney), F.R.A.C.S. Honorary Ear, Nose and Throat Surgeon, Sydney Hospital and Eastern Suburbs Hospital, Sydney; Consulting Ear, Nose and Throat Surgeon, Canterbury District Memorial Hospital, Sydney. Sydney: Angus and Robertson, Ltd., 89-95 Castlereagh Street, 1943. Three hundred ninety-six pages with Index and 135 illustrations.

This book is intended for the undergraduate medical students rather than the postgraduate student of otolaryngology.

The illustrations are good; however, it seems a pity that in a book for the undergraduate student such detail of guillotine tonsillectomy should have been given. The book is of reasonable length, and if it is readily available should be useful as required reading for undergraduate students.

T. E. W.

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**Office Treatment of the Nose, Throat and Ear.** By Abraham R. Hollender, M.Sc., M.D., F.A.C.S. Associate Professor of Laryngology, Rhinology and Otology, University of Illinois College of Medicine; Otolaryngologist, Research and Educational Hospitals, Chicago. Four hundred pages including Index and approximately 50 illustrations. Chicago: The Year Book Publishers, 304 South Dearborn Street. 1943. Price \$5.00.

The author has compiled a good survey of the proven methods of treatment of diseases of the ear, nose and throat. The first part of the book contains a general survey of various methods of treatment and the latter half is confined to the more specific treatments of the different entities.

The book is well illustrated, contains a very adequate reference, and should prove useful to otolaryngologists.

T. E. W.

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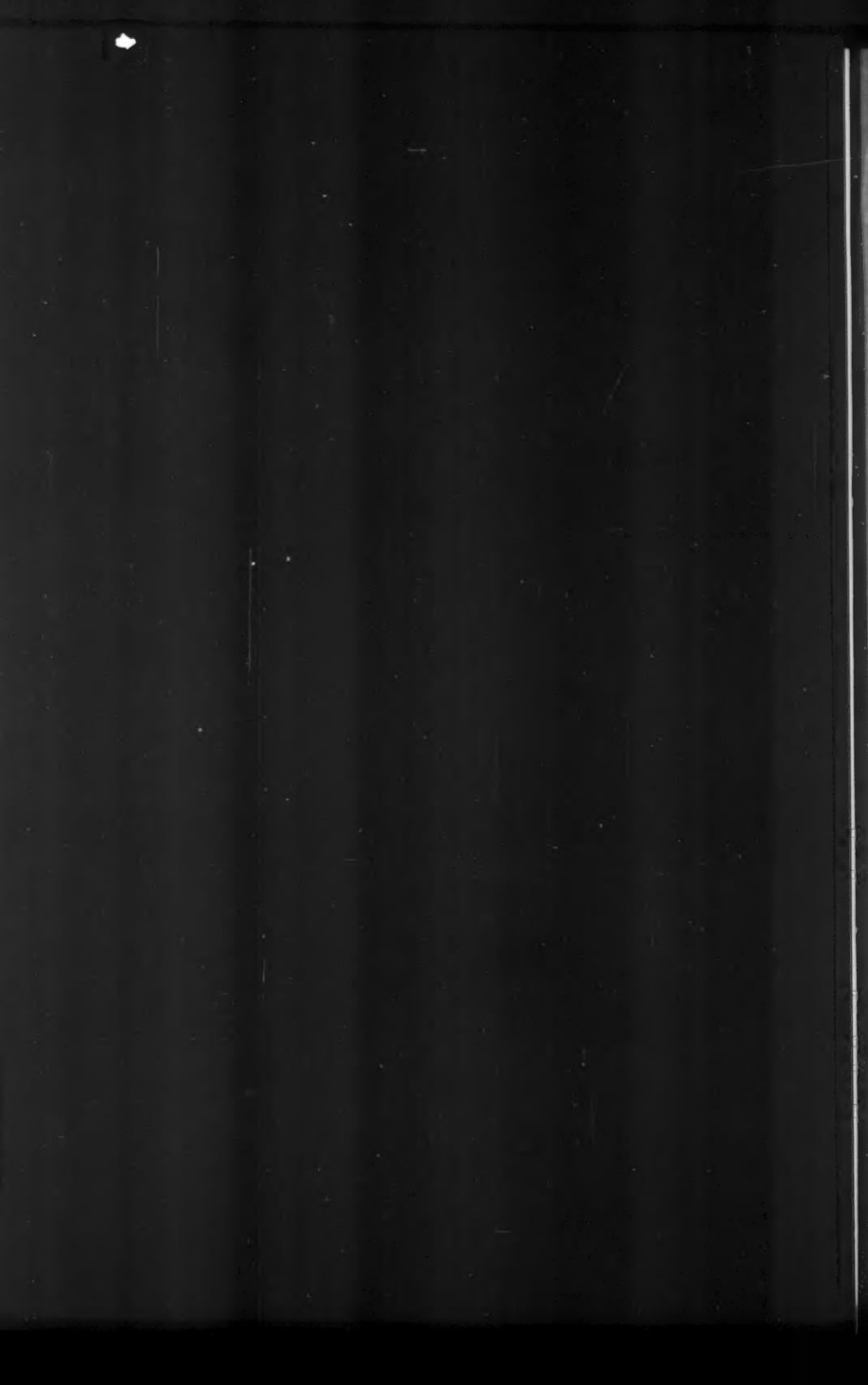
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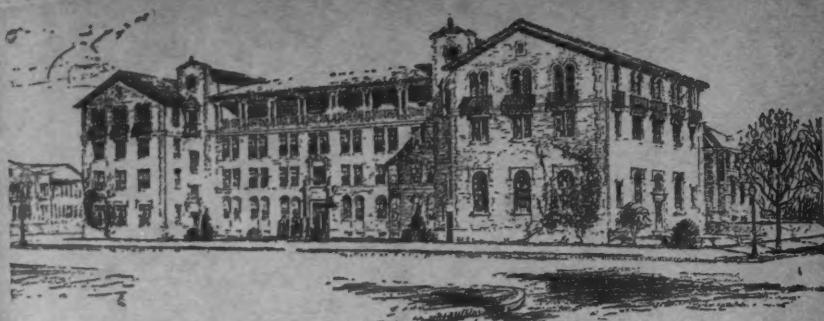
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